

Amendment

U.S. Patent Application No. 09/963,669

REMARKS

Claims 1 – 45 are pending in the subject application, and all of the claims stand rejected. By the above amendments, claims 2, 4, and 40 have been amended. Favorable reconsideration of the application and allowance of all of the pending claims are respectfully requested in view of the above amendments and the following remarks.

The Examiner objects to the disclosure due to an informality. Applicant has amended the specification to list the patent number of the now-issued document cited therein, as requested. Further, Applicant has amended the subsequent paragraph on page 11 of the specification to correct a minor typographical error.

Claims 2 – 4 and 30 are objected to due to minor informalities. Applicant has amended these claims as suggested by the Examiner; accordingly, the Examiner is requested to withdraw this objection.

Claims 1 – 45 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,044,071 to Spilker, Jr. in view of a publication by Butman et al. Applicant respectfully traverses this rejection for the following reasons.

As reflected in each of independent claims 1, 15, and 31, the invention relates to using the combination of majority voting and interplex modulation to combine a plurality of signals into a constant-envelope composite signal for transmission. Majority voting is a known technique for combining signals to form a constant-envelope composite signal, as explained in Applicant's specification and as described by Spilker. Likewise, as explained in Applicant's specification and as described by Butman, interplex modulation is also a known technique for combining signals to form a constant-envelope composite signal.

However, as also explained in Applicant's specification, both majority voting and interplex modulation have inefficiencies in certain situations. Majority voting can become inefficient with a larger number of signals, and interplex modulation can become inefficient if the relative powers of the signals differ significantly. What Applicant has discovered is that these inefficiencies largely can be avoided in certain situations by using a combination of majority voting and interplex modulation. As recited in claim 1, for example, a subset of a

Amendment

U.S. Patent Application No. 09/963,669

plurality of signals to be combined in a constant-envelope composite signal for transmission are combined by majority voting to form a majority voted signal. The majority voted signal and the remaining signals are then combined via interplex modulation to form the constant-envelope composite signal for transmission. The use of these two techniques in the claimed combination can avoid the inefficiencies inherent in majority voting and interplex modulation individually.

While both majority voting and interplex modulation are well-known techniques for generating constant-envelope composite signals, there is no suggestion anywhere in the prior art to employ a combination of these two techniques. More specifically, it would not have been obvious from the prior art to combine a subset of signals via majority voting and then to combine the remaining signals and the majority voted signal via interplex modulation to form a composite signal for transmission, as required by the independent claims.

No combination of Spilker and Butman would have rendered obvious the claimed combination of majority voting and interplex modulation. These documents teach nothing more than what is already described in the background section of Applicant's specification; namely, that both techniques represent a significant improvement in power efficiency over conventional PSK/PM techniques. Note, in particular, the passages on page 2, lines 4-6 and 15-18 which specifically point out that these techniques provide a significant improvement over PSK/PM. What is lacking in Spilker and Butman, taken in combination, is any suggestion or motivation to use both majority voting and interplex modulation in combination.

Applicant respectfully submits that the Examiner misinterprets what Spilker teaches. Contrary to the Examiner's assertion, Spilker does not involve or suggest combining five signals (or the need to combine five signals) for transmission as a composite, constant envelope signal. Rather, Spilker repeatedly and clearly describes combining three signals via majority voting. Reference to combining exactly "three" signals is provided at column 2, line 58-61; column 5, line 11; column 5, lines 28-30; column 11, lines 52-57; and column 6, lines 22-24. The Examiner lists five signals, arguing that Spilker combines three of the five via majority voting. However, the two other signals listed by the Examiner are local signals that are not transmitted at all, much less as part of a constant-envelope composite signal, as required by the claims. The

Amendment

U.S. Patent Application No. 09/963,669

claims clearly require the majority vote to be performed on a subset of the plurality of signals being combined to form the constant-envelope composite signal for transmission, not just a subset of any set of signals. Thus, the Examiner's apparent suggestion that Spilker has two additional signals that need combining with the three majority-voted signals is incorrect.

As the Examiner correctly points out, Butman teaches interplex modulation. The Examiner argues that it would have been obvious to modify Spilker's BPSK modulator with the interplexing feature taught by Butman "to reduce the cross-modulation loss for improving the performance of multichannel system (Abstract)." Applicant respectfully submits that this argument is incorrect for a number of reasons. First, Spilker has no need for both majority voting and interplex modulation. Spilker's system requires combining three signals to form a constant-envelope composite signal. Spilker discloses combining these three signals via majority voting. Once combined, there is no need for interplex modulation, since the signals are already combined (as explained at length in Applicant's specification (and in Butman), interplex modulation is, like majority voting, a technique for combining signals). Thus, there is no apparent reason why one would have added interplex modulation to Spilker's system, since, after majority voting, there is no set of signals that requires further combining for transmission.

Further, although not entirely clear, the Examiner's arguments appears to imply that interplex modulation is a modulation technique that could be used more or less as a substitute for other "modulation" techniques, such as BPSK. As is evident from Applicant's claims and from the lengthy description provided in the specification, interplex modulation is a technique for combining a plurality of signals to form a constant-envelope, composite signal. It is not a substitute for or equivalent to modulation techniques such as BPSK. In fact, as shown in Fig. 4 of the application, a number of BPSK modulators can be used along with other components to implement an interplex modulation scheme. Thus, one would not have substituted or employed interplex modulation in the BPSK modulator of Spilker without the need to combine signals. This need is met in Spilker by the majority voting technique. Again, there is no need for both majority voting and interplex modulation within Spilker's system; the three signals to be transmitted are combined just fine by the majority voting.

Amendment

U.S. Patent Application No. 09/963,669

Moreover, the Examiner's stated motivation for inclusion of interplex modulation in Spilker's system is that it would reduce the cross-modulation loss. There is nothing in either Butman or Spilker to support this assertion. As plainly stated in the Introduction section of Butman, interplex modulation reduces cross-modulation power loss relative to a conventional PSK/PM scheme. As previously noted, this fact is expressly stated in Applicant's specification on page 4, line 4-6. However, as expressly stated on page 4, lines 15-18, majority voting also "represents a significant improvement over PSK/PM." Butman is completely silent as to whether interplex modulation would provide any power efficiency improvement in the context of a system already employing majority voting. All of Butman's comparative statements are with respect to conventional PSK/PM modulation. Thus, even if one could figure out a meaningful way to incorporate interplex modulation into Spilker's majority voting scheme, it is not at all clear from either reference, or anything else in the prior art, that the resulting system would be more efficient.

Applicant has determined that it is, in fact, more efficient in certain situations to combine a plurality of signals into a constant-envelope composite signal by first majority voting a subset of the signals being combined and then combining the majority voted signal with the remaining signals by interplex modulation to form the composite signal for transmission. Spilker relates exclusively to majority voting and Butman relates exclusively to interplex modulation. To suggest that combining the two techniques would result in a more efficient approach would require the use of impermissible hindsight gained from the detailed analysis provided in Applicant's own disclosure. More generally, considering both Spilker and Butman together, there is simply nothing that suggests a need for or advantage to using both majority voting and interplex modulation, much less how the two techniques could be implemented in combination. Applicant's discovery that initially combining a subset of the signals by majority voting and then combining the majority voted signal with the remaining signals efficiently produces a composite signal would not have been evident from Spilker and Butman. Thus, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 1-45.

Amendment

U.S. Patent Application No. 09/963,669

In view of the foregoing, Applicant respectfully requests the Examiner to find the application to be in condition for allowance with claims 1 – 45. However, if for any reason the Examiner feels that the application is not now in condition for allowance, the Examiner is respectfully requested to call the undersigned attorney to discuss any unresolved issues and to expedite the disposition of the application.

Filed concurrently herewith is a Petition (with payment) for an Extension of Time of One Month. Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case, and any required fee for such extension is to be charged to Deposit Account No. 05-0460.

Respectfully submitted,



Patrick J. Finnegan
Registration No. 39,189

EDELL, SHAPIRO & FINNAN, LLC
1901 Research Boulevard, Suite 400
Rockville, Maryland 20850-3164
(301) 424-3640

Hand Delivered on: September 6, 2005